

a first fiber section having a light input end and a light output end and having a first predetermined diameter;

a tapered fiber section of a predetermined length having an input end of said first predetermined diameter optically coupled with the output end of said first fiber section and having an output end of a second predetermined diameter greater than said first predetermined diameter,

a ferrule that is large enough to encase the tapered fiber section, and

a lens surface that is optically coupled with the output end of the tapered fiber section.

6. The combination according to Claim 5 wherein said tapered fiber section has a uniform taper from the light input end thereof to the light output end thereof.
7. The combination according to claim 6 wherein said tapered fiber section has a generally conical shape.
8. The combination according to Claim 7 wherein said first end of said tapered fiber section is physically coupled with the output end of said first fiber section.
9. The combination according to claim 8 wherein said tapered fiber section is integrally formed with said first fiber section on the output end thereof.
10. The combination according to Claim 9 wherein said first fiber section and said tapered fiber section comprise glass fibers.
11. The combination according to Claim 10 wherein the taper of said tapered fiber section from the input end thereof to the output end thereof is at least 3:1.
12. The combination according to Claim 11 further including a collimating lens on the output end of said tapered fiber section.
13. The combination according to Claim 5 wherein said tapered fiber section has a uniform taper angle  $\Theta$ .
14. The combination according to Claim 13 wherein said tapered fiber section has a generally conical shape.

- cont.  
a1
15. The combination according to Claim 5 wherein said first end of said tapered fiber section is physically coupled with the output end of said first fiber section.
  16. The combination according to Claim 15 wherein said first fiber section and said tapered fiber section comprise glass fibers.
  17. The combination according to Claim 16 wherein said tapered fiber section has a generally conical shape.
  18. The combination according to Claim 5 wherein said tapered fiber section is integrally formed with said first fiber section on the output end thereof.
  19. The combination according to Claim 5 wherein said tapered fiber section is integrally formed with said first fiber section on the output end thereof.
  20. The combination according to Claim 5 further including a collimating lens on the output end of said tapered fiber section.
  21. The combination according to Claim 5 wherein said first fiber section and said tapered fiber section comprise glass fibers.
  22. An optical fiber assembly with Numerical Aperture (NA) compression including in combination:
    - an illumination fiber section having a light input end and a light output end and having a first predetermined diameter;
    - a first tapered fiber section having a predetermined length with an input end of said first predetermined diameter and optically coupled with the output end of said illumination fiber section, and having an output end having a second predetermined diameter greater than said first predetermined diameter; and
    - a collection fiber section having a light input end and a light output end, said collection fiber section is physically located with the light input end thereof adjacent the light output of said tapered fiber section and optically coupled to the light output of said tapered fiber section by a reflective or scattering surface.
  23. The combination according to Claim 22 wherein said output end of said illumination fiber section is physically and optically coupled with the input end of said first tapered section.

- Cont. d  
a1*
24. The combination according to Claim 22 wherein said collection fiber section is a second tapered fiber section, and the light output end of said second tapered fiber section has a second predetermined diameter, and the light input end of said second tapered fiber section has a third predetermined diameter greater than said second predetermined diameter.
  25. The combination according to Claim 24 wherein said illumination fiber section, said first tapered fiber section and said collection fiber section all comprise glass fiber material.
  26. The combination according to claim 25 wherein said collection fiber section comprises a plurality of substantially identical collection fiber sections.
  27. The combination according to Claim 26 wherein said plurality of collection fiber sections are physically arranged with the light input ends thereof around said first tapered fiber section.
  28. The combination according to Claim 27 wherein the output of said first tapered fiber section and the input ends of said collection fiber sections are fused to one another.
  29. The combination according to Claim 28 wherein said output end of said illumination fiber section is physically and optically coupled with the input end of said first tapered section.
  30. The combination according to Claim 22 wherein said illumination fiber section, said first tapered fiber section and said collection fiber section all comprise glass fiber material.
  31. The combination according to Claim 22 wherein said collection fiber section comprises a plurality of substantially identical collection fiber sections.
  32. The combination according to Claim 31 wherein said plurality of collection fiber sections are physically arranged with the light input ends thereof around said first tapered fiber section.
  33. The combination according to Claim 32 wherein the output of said first tapered fiber section and the input ends of said collection fiber sections are fused to one another.
  34. The combination according to Claim 22 wherein said plurality of collection fiber sections are physically arranged with the light input ends thereof around said first tapered fiber section.
-